

APPENDIX H

Water Quality and Protection

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AMBIENT WATER QUALITY

Ambient Ground Water Quality Distribution

A ground water study conducted by the SFWMD (Lukasiewicz and Switanek, 1994) collected and analyzed water sample from 134 Surficial Aquifer System (SAS) wells and 52 Floridan Aquifer System (FAS) wells in the UEC Planning Area during the time interval between 1989 to 1990. Most wells were sampled at the end of the wet and dry seasons between May 1989 and May 1990 and were analyzed for physical parameters, major ions, and specific trace metals. Figures H-1 through H-5 show the distribution of chlorides, total dissolved solids, and hardness for the SAS and FAS wells.

Statewide Ambient Ground Water Quality Monitoring Network

In 1983, the State of Florida passed the Water Quality Assurance Act (WQAA). Part of the WQAA provided for the establishment of a statewide Ambient Ground Water Quality Monitoring Network. The purpose of this network is to establish a ground water quality monitoring network to detect or predict contamination of the state's ground water resources. Water sampling began in September 1984, and samples are collected and analyzed periodically. This monitoring network has 13 locations in the UEC Planning Area. Information on station locations and ground water quality is available through the District's GWIS database (Herr and Shaw, 1989).

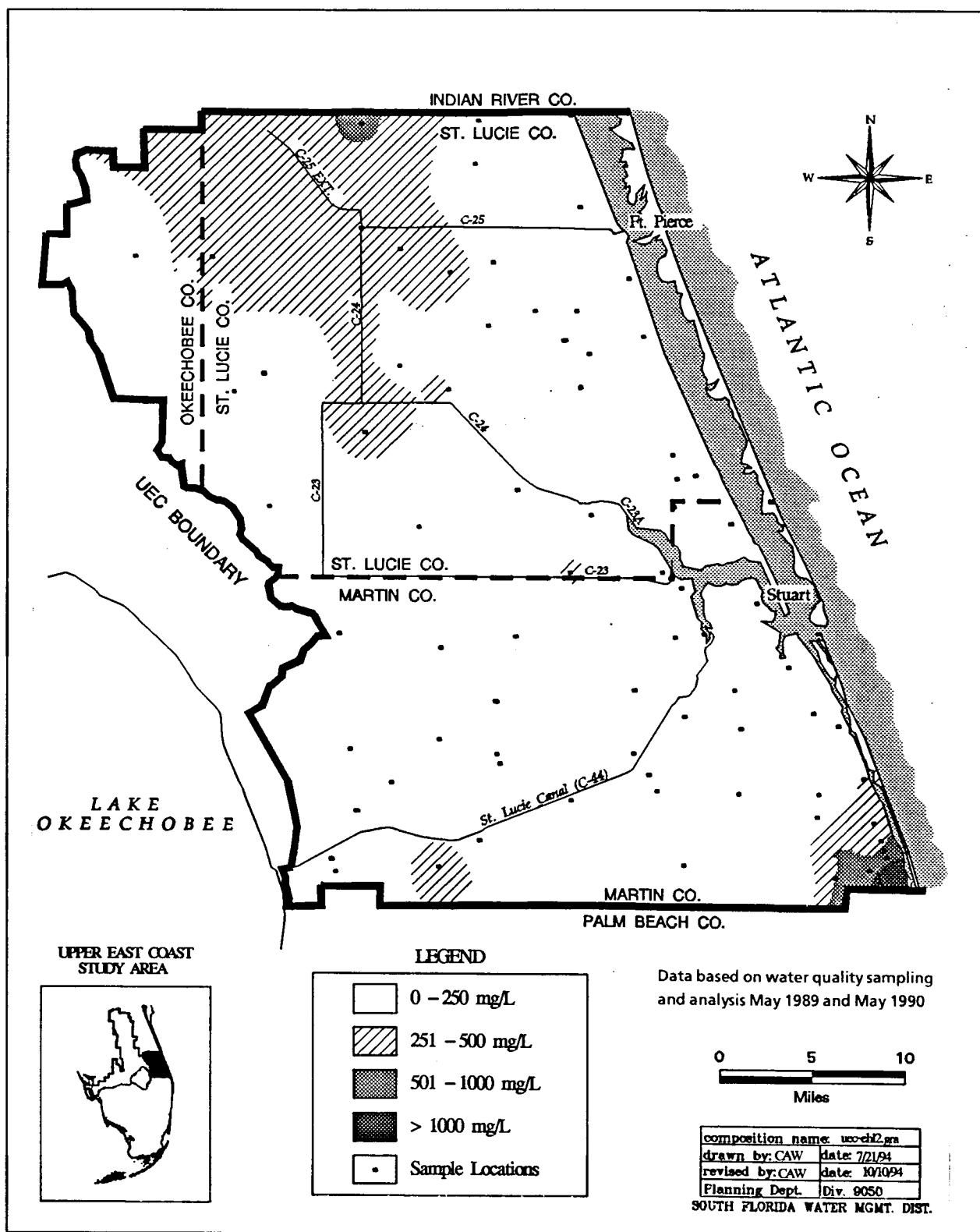


FIGURE H-1. Surficial Aquifer System Chloride Distribution (after Lukasiewicz and Switanek, 1994).

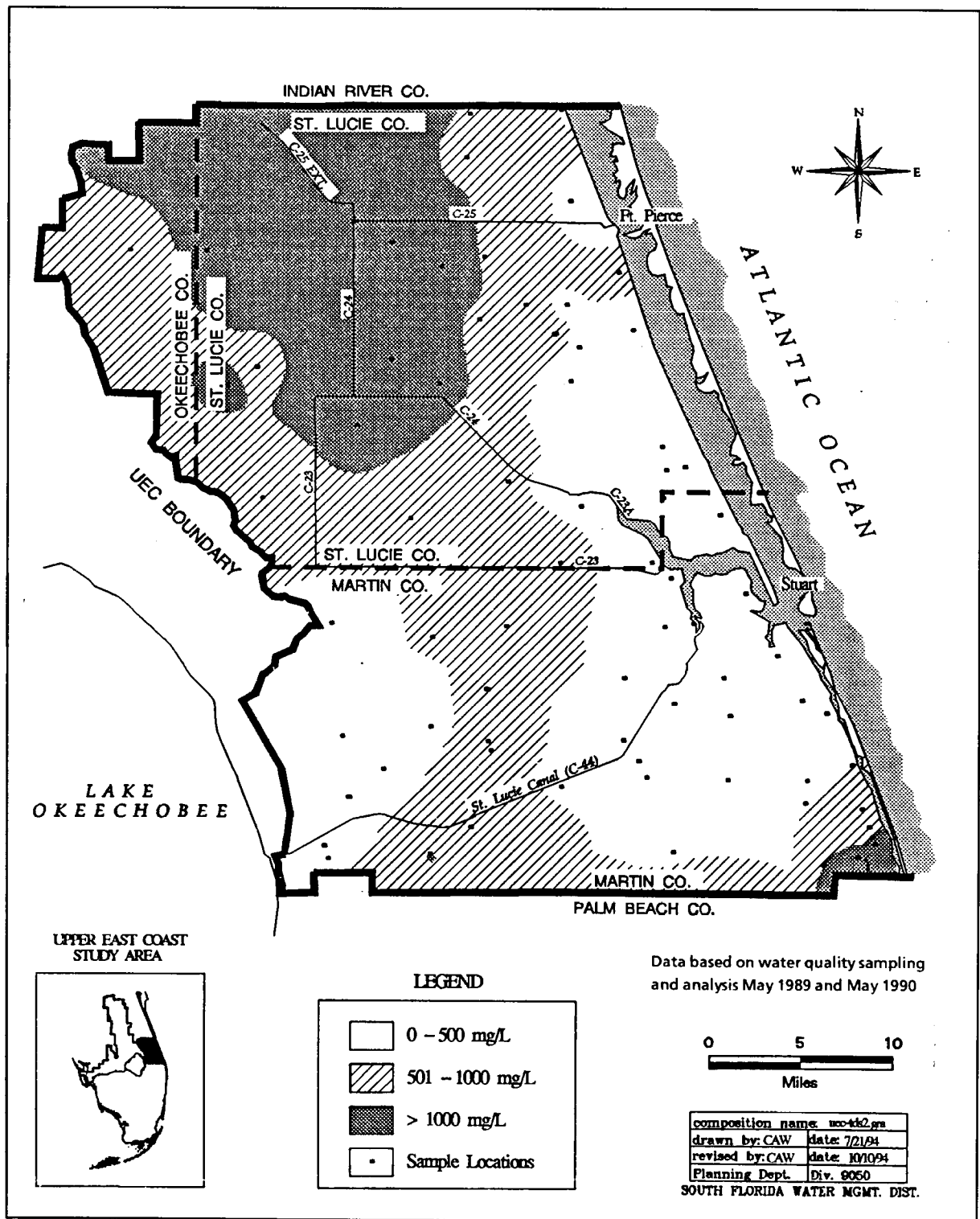


FIGURE H-2. Surficial Aquifer System Total Dissolved Solids Distribution (after Lukasiewicz and Switanek, 1994).

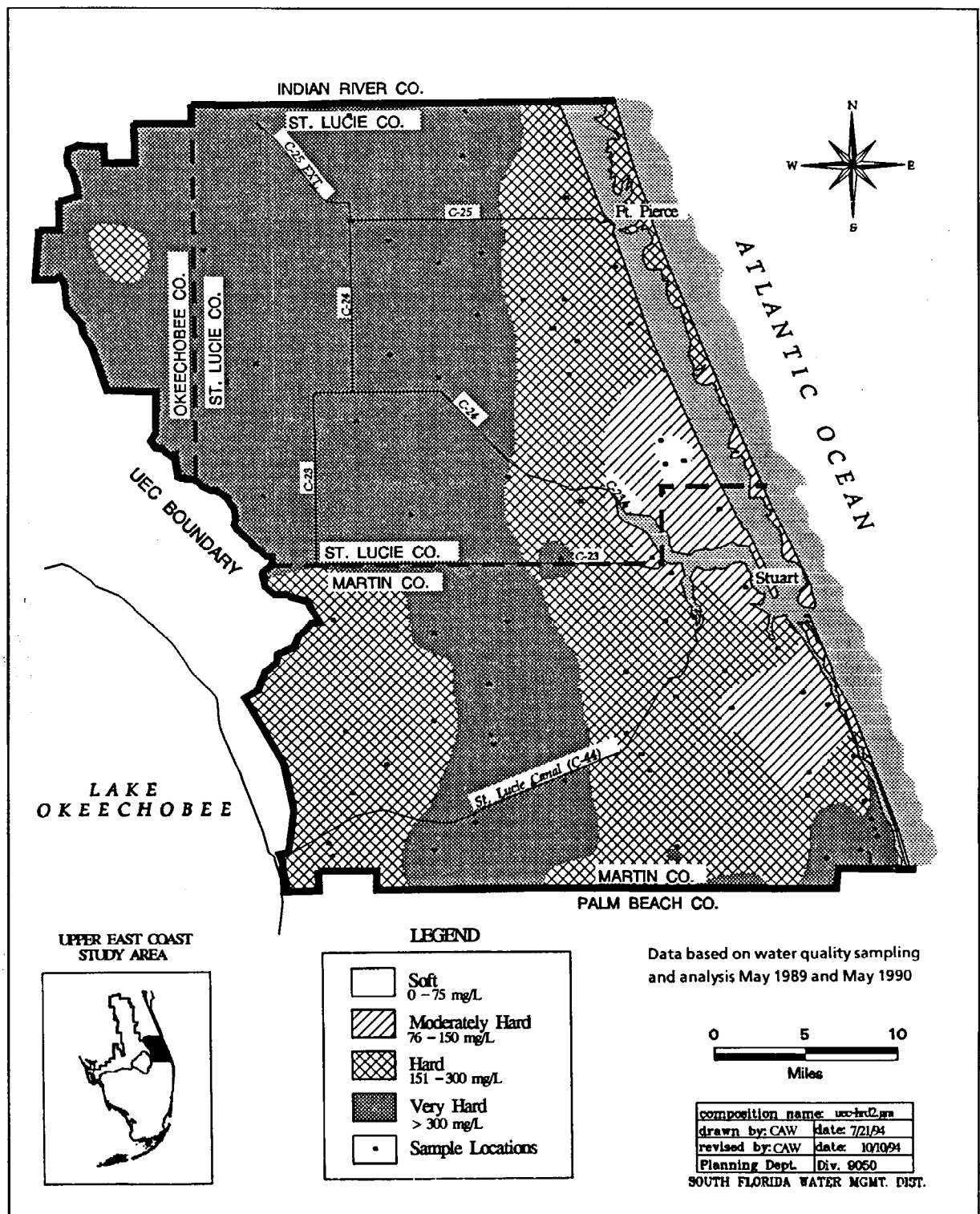


FIGURE H-3. Surficial Aquifer System Hardness Distribution (after Lukasiewicz and Switanek, 1994).

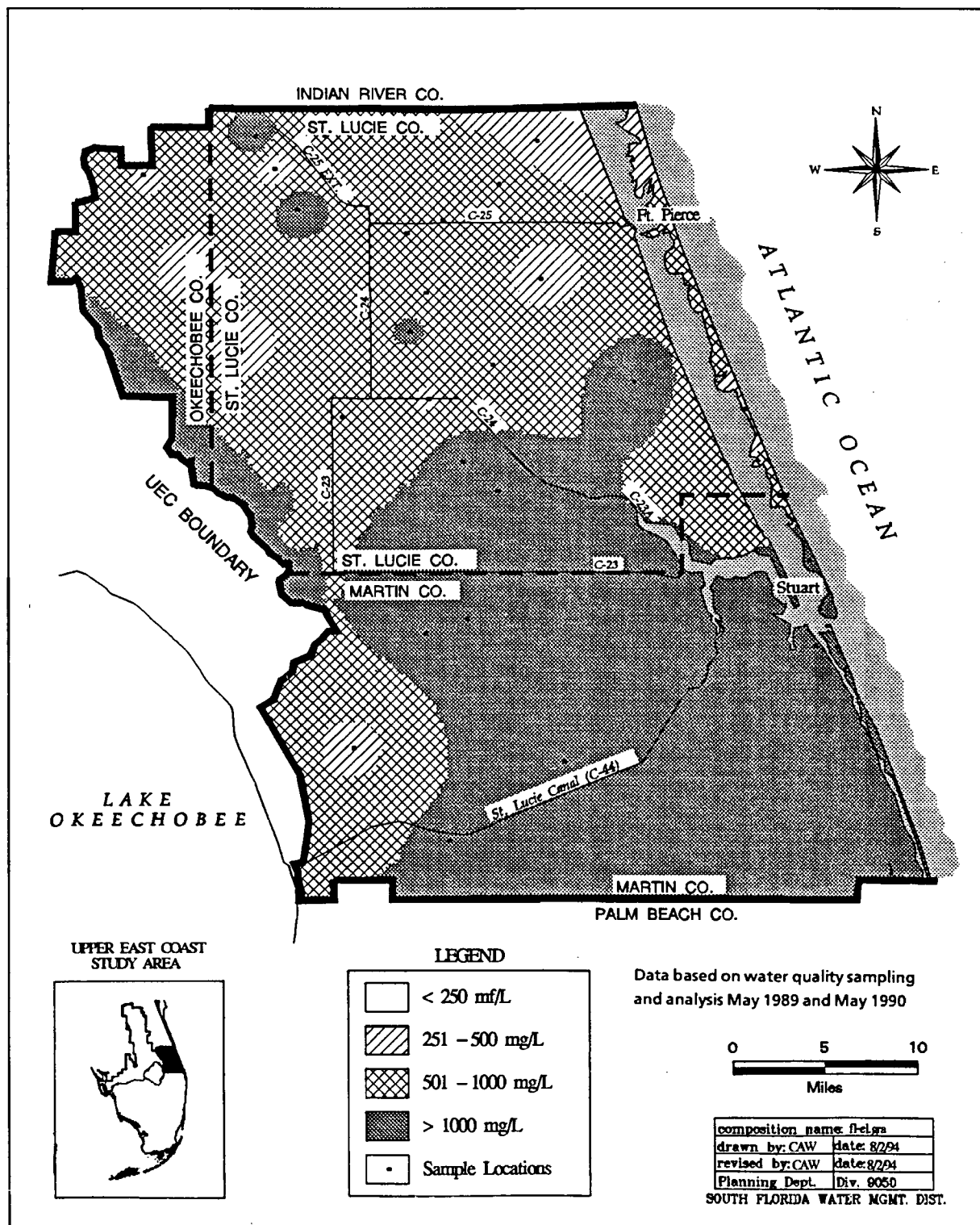


FIGURE H-4. Floridan Aquifer System Chloride Distribution (after Lukasiewicz and Switanek, 1994).

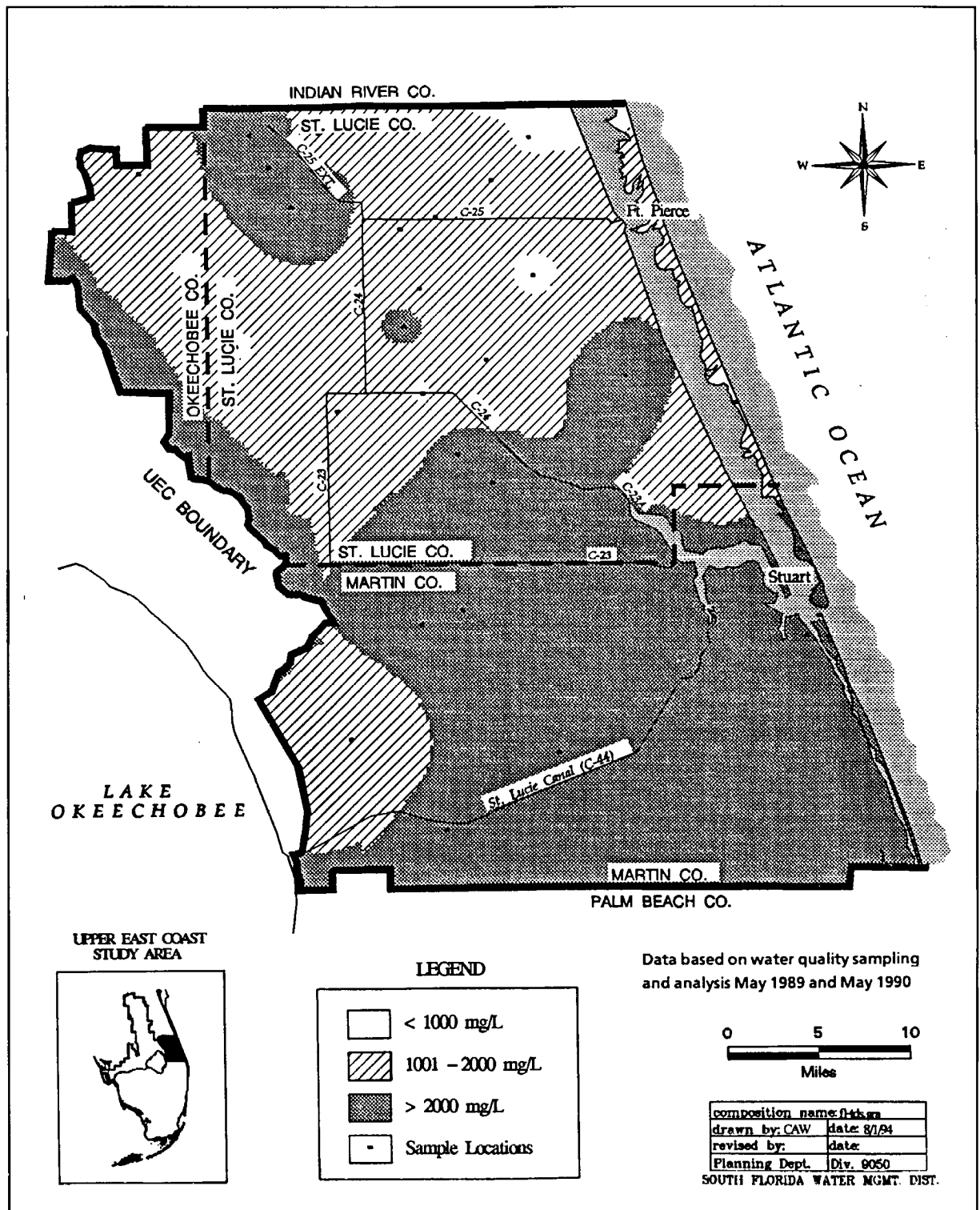


FIGURE H-5. Floridan Aquifer System Total Dissolved Solids Distribution (after Lukasiewicz and Switanek, 1994).

Surface Water Quality Monitoring Network

The District's Surface Water Quality Monitoring Network was initiated in 1979 for the coastal portions of the UEC Planning Area. Water quality monitoring stations are shown in Figure H-6. The following is a description of each site:

C25S99: S-99 is a gate-type structure located inland on C-25 near Fort Pierce. Water flows eastward over this structure. Water samples are collected from the upstream side of this structure.

C25S50: S-50 is a weir structure located on C-25 near Ft. Pierce. This coastal structure is downstream from S-99. Water flows eastward over this structure and is mixed with saltwater on the downstream side. Water samples are collected from the upstream side of this structure.

C24S49: S-49 is a gate-type coastal structure located on C-24 in Port St. Lucie. This structure is about 1/2 mile west of the Florida Turnpike. Water flows eastward through this structure into the St. Lucie River. Water samples are collected from the upstream side of this structure.

C23S97: S-97 is a gate-type structure located inland on C-23 about 1/2 mile west of the Florida Turnpike. Water flows eastward through this structure. Water samples are collected from the upstream side.

C23S48: S-48 is a weir coastal structure located downstream of S-97 on C-23. The water flows eastward over this structure into the St. Lucie River. Water samples are collected from the upstream side of this structure.

C44S80: S-80 is a large gate and boat lock coastal structure located on the St. Lucie Canal and operated by the U.S. Army Corps of Engineers. The water flows northeast through this structure into the St. Lucie River. Water samples are collected from the upstream side of this structure.

Physical parameters and nutrients are sampled and analyzed routinely once a month for the coastal stations. Major cations are added to the list of routine parameters four times a year, and total trace metals are analyzed twice a year (Germain and Shaw, 1988). The remaining inland stations are sampled only if there was a discharge at any time during a one week period prior to the monthly scheduled sampling date.

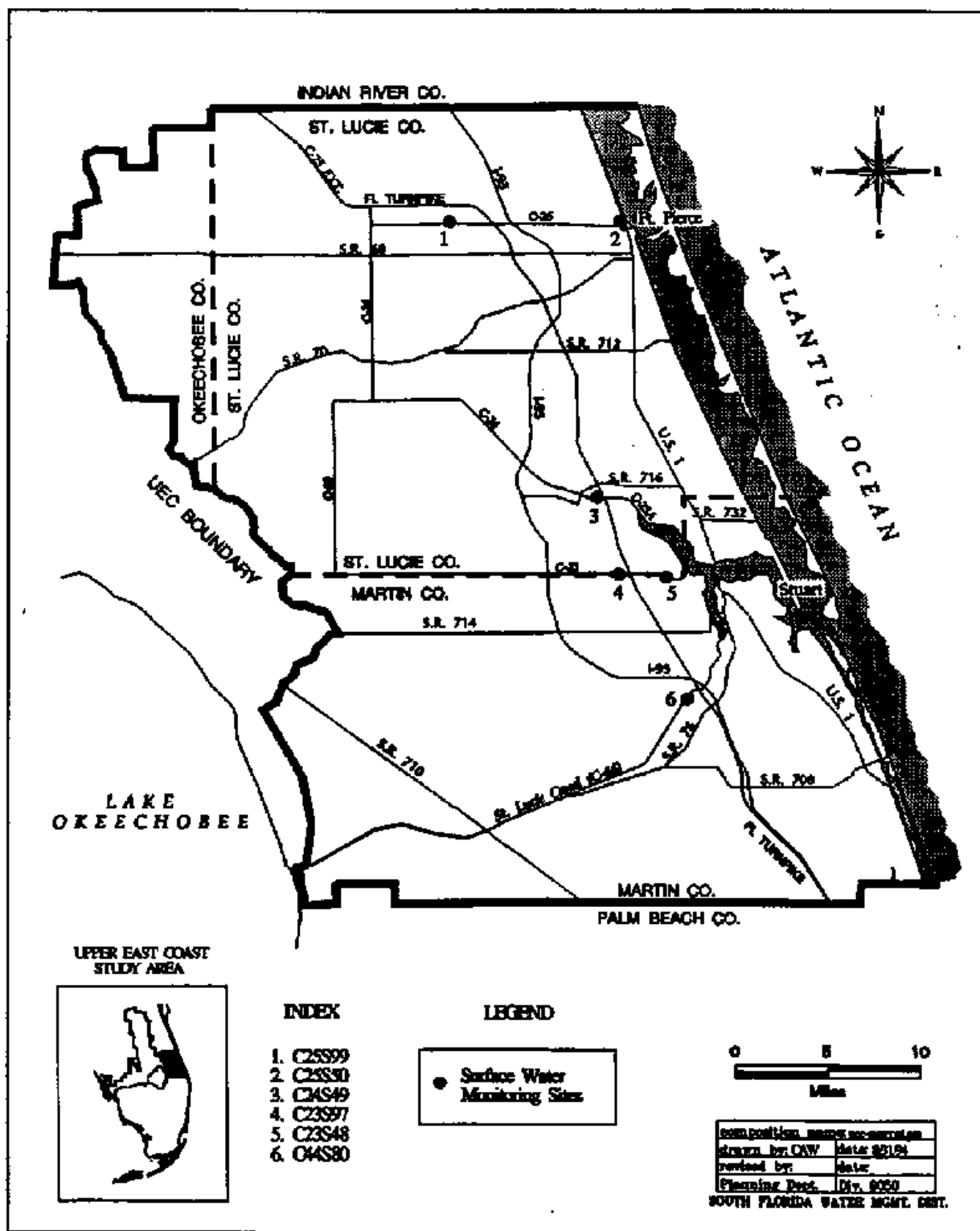


FIGURE H-6. Surface Water Quality Monitoring Network in the UEC Planning Area.

DRINKING WATER STANDARDS

Current FDEP primary and secondary drinking water standards are shown in tables H-1 and H-2. Primary drinking water standards include contaminants which can pose health hazards when present in excess of the maximum contaminant level (MCL). Secondary drinking water standards, commonly referred to as aesthetic standards, are those parameters which may impart an objectionable appearance, odor or taste to water, but are not necessarily health hazards.

TABLE H-1. FDEP Primary Drinking Water Standards.
(Chapter 17-550, F.A.C. -- revised July 1993)

ORGANICS	MCL* mg/L	INORGANICS	MCL* mg/L
<u>Volatile Organics</u>		<u>Contaminant</u>	
Vinyl chloride	0.001	Antimony	0.006
Benzene	0.001	Arsenic	0.05
Carbon tetrachloride	0.003	Asbestos	7 MFL**
1,2-Dichloroethane	0.003	Barium	2
Trichloroethylene	0.003	Beryllium	0.004
para-Dichlorobenzene	0.075	Cadmium	0.005
1,1-Dichloroethylene	0.007	Chromium	0.1
1,1,1-Trichloroethane	0.2	Cyanide	0.2
cis-1,2-Dichloroethylene	0.07	Fluoride	4.0***
1,2-Dichloropropane	0.005	Lead	0.015
Ethylbenzene	0.7	Mercury	0.002
Monochlorobenzene	0.1	Nickel	0.1
o-Dichlorobenzene	0.6	Nitrate	10 (as N)
Styrene	0.1	Total Nitrate and Nitrate	10 (as N)
Tetrachloroethylene	0.003	Selenium	0.05
Toluene	1	Sodium	160
trans-1,2-Dichloroethylene	0.1	Thallium	0.002
Xylenes (total)	10		
Dichloromethane	0.005		
1,2,4-Trichlorobenzene	0.07		
1,1,2-Trichloroethane	0.005		
<u>Total Trihalomethanes</u>	0.10		
The sum of concentrations of bromodichloromethane, dibromochloromethane, dibromochloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform).			
PESTICIDES & PCBS		TURBIDITY	
Alachlor	0.002	<u>Surface Water</u>	
Atrazine	0.003	- One turbidity unit (NTU) when based on a monthly average.	
Carbofura	0.04	- Five turbidity units (NTU) when based on an average for two consecutive days.	
Chlordane	0.002	<u>Ground Water</u>	
Dibromochloropropane	0.0002	- One turbidity unit (NTU)	
2,4-D	0.07		
Endrin	0.002		
Ethylene dibromide	0.00002	MICROBIOLOGICAL	
Heptachlor	0.0004	<u>Coliform Bacteria</u>	
Heptachlor epoxide	0.0002	- Presence/Absence	
Lindane	0.0002		
Methoxychlor	0.04		
Polychlorinated biphenyl (PCB)	0.0005	RADIONUCLIDES	MCL*
Pentachlorophenol	0.001	- Combined radium-226 and radium-228	5 pCi/L
Toxaphene	0.003	- Gross alpha activity, including radium-226 but excluding radon and uranium	15 pCi/L
2,4,5-TP (Silvex)	0.05	- Manmade radionuclides	4 millirem/yr
Dalapon	0.2	- Tritium/total body	20,000 pCi/L
Di(2-ethylhexyl)phtalate	0.006	- Strontium-90/bone marrow	8 pCi/L
Di(2-ethylhexyl)adipate	0.4		
Dinoseb	0.007		
Diquat	0.02		
Endothall	0.1		
Glyphosate	0.7		
Hexachlorobenzene	0.001		
Hexachlorocyclopentadiene	0.001		
Oxamyl (vydate)	0.2		
Benzo(a)pyrene	0.0002		
Picloram	0.5		
Simazine	0.004		

*MCL = maximum contaminant level

**MFL = million fibers per liter > 10 micrometers

***Fluoride also has a secondary standard

TABLE H-2. FDEP Secondary Drinking Water Standards.
 (Section 17-550.320, F.A.C. -- as amended July 3, 1993).

Contaminant	MCL (mg/L)*
Aluminum	0.2
Chloride	250
Color	15 color units
Copper	1
Fluoride	2.0
Foaming agents	0.5
Iron	0.3
Manganese	0.05
Odor	3**
pH (at collection point)	6.5 - 8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids	500***
Zinc	5
Total Trihalomethanes	0.10

* Except color, odor, corrosivity, and pH.
 ** Threshold odor number
 *** May be greater if no other MCL is exceeded.

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IRRIGATION WATER QUALITY

Chemical parameters of an irrigation water that affect plant growth, yield, and appearance, soil conditions, and the ground water quality governs the applicability of a water. The University of California Cooperative Extension Service has developed a useful and widely accepted guide to evaluate the suitability of an irrigation water and identifying potential areas of concern. Problems and related constituents include salinity, permeability, specific ion toxicity (sodium, chloride, boron), nitrogen, bicarbonate, and pH. These guidelines can be found in "Water Treatment Principles and Design" (J.M. Montgomery Consulting Engineers, 1985).

In addition to these guidelines, recommended maximum concentration for trace elements have been developed and can be found in J.M. Montgomery Consulting Engineers, 1985.

Salinity

Salinity is a measure of the soluble salts, or the ionic activity of a solution in terms of its capacity to transmit current, in a water and is determined by measuring the water's electrical conductivity (EC) or specific conductance. Water salinity is the most important parameter in determining the suitability of water for irrigation. As salinity increases in irrigation water, the probability for certain soil, water, and cropping problems increases. There are several dissolved salts found in water, the principal salts being the chloride and sulfate salts of sodium, calcium, and magnesium (Augustin *et al.*, 1986). Many salts, such as nitrogen, phosphorus, calcium, and potassium are necessary for normal plant growth.

Salt is added continuously via the irrigation water to the soil. Over time, a salinity problem to the plant may occur if the accumulated soil salt concentration increases to where it is harmful to the plant. The accumulation is dependent on the quantity of salt applied and the rate at which salt is removed by leaching. Leaching is essential to successfully irrigate with highly saline water. To assure that salt leaching occurs, additional irrigation water could be applied. Establishment of a net downward movement of water and salts is the only practical way to manage a salinity problem. In addition, under these circumstances, good drainage and/or percolation is essential in allowing movement of the water and salt below the root zone. The climate in an area also affects soil salt accumulation. Evaporation and transpiration remove water and leave the salts behind. Climate also influences the salt tolerance of plants, which will be discussed later.

Ground water salt content increases due to upconing or saline water intrusion. For reclaimed water, salts enter the wastewater stream in many different ways. Salts are contained in drinking water, are introduced through domestic and industrial activities, through water softeners, and through infiltration and inflow (I/I) into the

wastewater collection system. Infiltration is where ground water enters the collection system through defective joints, cracked and broken pipes and manholes, whereas inflow is where storm water enters the collection system through combined sewers, manhole covers, foundation drains and roof drains. In coastal areas, I/I of seawater can be major source of salts in the reclaimed water. The advanced secondary wastewater treatment process has little effect on removal of salts from the wastewater stream.

Knox and Black (n.d.) provide a table indicating the degree of salt tolerance of many of the landscape plants adapted to South Florida, including trees, palms, shrubs, ground covers, and vines. Many of the salts are necessary for healthy plant growth; however, excessive concentrations of these salts can have a negative impact on the plant. Salts affect plant growth by: (1) osmotic effects, (2) specific ion toxicity, and (3) soil particle dispersion.

Osmotic Effects

Osmosis is the attraction of dissolved salts which causes water to move from areas of low salt concentration to areas of high salt concentration. Roots selectively absorb compounds that the plant needs to grow. The normal osmotic flow causes water to move from the soil, which is usually an area of low salt concentration, into the roots which is an area of higher salt concentration. Excessive salts in the soil can reverse the normal osmotic flow of water into the plant by reversing the salt concentration gradient, thus causing dehydration of the plant. Increased plant energy is also needed to acquire water and make biochemical adjustments necessary to survive, which will decrease plant growth and crop production. In addition, osmotic effects indirectly create plant nutrient deficiencies by decreasing the nutrient absorption. The salt tolerance of common turf grass species in South Florida can be found in "Saline Irrigation of Florida Turfgrasses" (Augustin *et al.*, 1986).

Deposition of salts on foliage through spray irrigation may also cause problems, especially to sensitive ornamental plants. Much work has been devoted to quantify the tolerance of many of the plants. Many researchers have identified the salt tolerance of plants through field observation and have categorized them as having poor, moderate, or good salt tolerance. Several of their publications are available from the Florida Cooperative Extension Service Institute of Food and Agricultural Sciences (IFAS).

Specific Ion Toxicity. Ion toxicity is due to excessive accumulations of specific ions in a plant that result in damage or reduced yield. Toxicity problems may or may not occur in the presence of a salinity problem. Specific ions of concern include boron, chloride, sodium, and bicarbonate. Ion toxicity potential is increased in hot climates. The ions can be absorbed by the plant through the roots or the foliage, but with sprinkler irrigation, sodium and chloride frequently accumulates by direct adsorption through the leaves. Such toxicity occurs at concentrations that are much lower than

toxicity caused by surface irrigation. Toxicity associated with overhead sprinkling is sometimes eliminated with night irrigation when lower temperatures and higher humidity exists. Tolerances of these ions vary from plant to plant.

Sodium. Sodium is not considered essential for most plants; however, it has been determined that sodium does positively affect some plants lower than the salt tolerance threshold. The amount of sodium is of concern because it is usually found in the largest amount. Sodium directly and indirectly affects plants. Direct affects of sodium toxicity involves the accumulation of this ion to toxic levels, which is generally limited to woody species (Maas, 1990). Indirect effects resulting from sodium toxicity include nutritional imbalance and impairment of the physical conditions of the soil. Sodium can affect the plant's uptake of potassium. Ornamental sodium toxicity is characterized by burning of the outer leaf edges of older leaves and progresses inward between the veins as severity increases. Sodium is usually introduced into the wastewater stream by I/I. With adequate care, sodium toxicity should not be a problem.

Chloride. Chloride is an essential micronutrient for plants and is relatively nontoxic. Most nonwoody crops, such as turf grass, are not specifically sensitive to chloride. However, many woody, perennial shrubs and fruit tree species are susceptible to chloride toxicity. In addition, chloride contributes to osmotic stress. Ornamentals express chloride toxicity by leafburn starting at the tip of older leave and progressing back along the edges with increasing severity. Chloride is usually introduced into the wastewater stream by I/I. With adequate care, chloride toxicity should not be a problem except possibly for irrigation of salt sensitive plants.

The City of St. Petersburg investigated the effect of reclaimed irrigation water on the growth and maturation of commonly used ornamental plants and trees in the St. Petersburg area. The study, called "Project Greenleaf" was also used to determine the chloride tolerance of those plants and trees (Parnell, 1987). The study suggested a chloride threshold of 400 mg/L be established for reclaimed water that is utilized for green space irrigation. This threshold protects salt sensitive ornamentals from the effects of chlorides, which generally have a lower salt tolerance than turf grasses.

Boron. Boron is an essential element to plants but can become toxic when concentrations of soil water slightly exceed the amount required for optimum growth. Boron is usually not a problem to turf grasses because boron accumulates in the leaf tips, which are removed by mowing; however, other landscape plants may be more sensitive to boron levels. Boron toxicity may be expressed by leaf tip burn or marginal burn accompanied by chlorosis of the interveinal tissue. Boron is commonly introduced to the wastewater stream from household detergents or from industrial discharges.

Water Infiltration Rate

In addition to other concerns with high sodium content, it can lead to deterioration of the physical condition of the soil by formation of crusts, water logging and reducing the soil permeability and nutritional problems induced by the sodium. An excess of sodium in the soil could displace nutrients such as calcium, iron, phosphorus, and magnesium from the soil particles and thereby creating a nutritional deficiency that the plant requires in addition to creating soil permeability problems (Knox, n.d.). Infiltration problems occur within the top few inches of the soil and is mainly related to the structural stability of the surface soil and is related to a relatively high sodium or very low calcium content in this zone or in the irrigation water. Reclaimed water usually contains sufficient amounts of both salt and calcium, such that dissolving and leaching of calcium from the surface soil is minimized.

Salt Levels in Soil

Good drainage is essential to leach soluble salts through the soil profile. To maintain a certain soil salt level, irrigation rates exceeding evapotranspiration are required to leach excess salts through the soil.

Salt Tolerance of Plants

Research has found that salt tolerance of plants usually relates to its ability to: (1) prevent absorption of chloride and sodium ions, (2) tolerate the accumulation of chloride or sodium ions in plant tissue, or (3) tolerate osmotic stress caused by soil or foliar salts. Plant tolerance to salts can be influenced differently based on the age of the plant, the stage of growth, irrigation management, and soil fertility. In addition, some plants are tolerant to soil salts but intolerant to salt deposits on the foliage, or vice versa.

The salt tolerance of plants varies greatly. Some plants avoid salt stress by either excluding salt absorption, extruding excess salts, or diluting absorbed salts. Other plants adjust their metabolism to withstand direct or indirect injury. Most plants utilize a combination of these. Turf grass salt stress is indicated by faster wilting than normal due to the osmotic stress, shoot and root growths are reduced to direct and indirect salt injury, leaf burn, general thinning of the turf and ultimately turf death. Landscape plant salt stress could be expressed by burning of the margins or tips of leaves followed by defoliation and death of salt sensitive plants.

Salt tolerance depends on many factors, conditions, and limits including type of salt, crop growing conditions, and the age and species of the plant. The type and purpose of the plant needs to be considered when evaluating salt tolerance. For example, for edible crops, yield is of primary importance and salt tolerance would be based on growth and yield. However, to establish permissible levels of salinity for ornamental plant species, the aesthetic characteristic of the plant is more important

than its yield. The loss or injury of leaves due to salt stress is unacceptable for ornamentals, even if growth is unaffected. Accordingly, landscape plants can tolerate relatively higher levels of salts, since reduced growth and yield are the initial effects of excess salts and appearance of plants is not immediately affected (Knox and Black, n.d.).

Climate is a major factor affecting salt tolerance. Most crops can tolerate greater salt stress if the weather is cool and humid than hot and dry. Rainfall also reduces salinity problems by diluting salt concentration and enhancing leaching by adding additional water. Nighttime irrigation reduces foliar absorption and injury. In addition, some plants may be tolerant to soil salinity but are not tolerant to salt deposition on the leaves and vice versa. Use of an irrigation technique that applies water directly to the soil surface rather than on the leaf surfaces is preferred when using irrigation water which contains excessive salts.

Nutrients

Reclaimed water contains nutrients that provide a fertilizer value to the crop or landscape, which when accounted for, can reduce the amount of fertilizer applied, thus reducing fertilizer costs. The nutrients found in reclaimed water occurring in quantities important to agriculture and landscape management include nitrogen and phosphorus and occasionally potassium, zinc, boron, and sulfur.

Municipal wastewaters usually contain sufficient amounts of micronutrients to prevent deficiencies. The trace elements of boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), sodium (Na), and chlorine (Cl) are essential for plant growth; however, intake of excessive concentration of these elements can be toxic and detrimental to some plants.

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GROUND WATER CONTAMINATION

There are many potential ground water contamination sources in the UEC Planning Area. These include landfills, petroleum storage tanks, hazardous material storage tanks, septic tanks, industrial waste sites and free-flowing FAS artesian wells. This section focuses on solid waste disposal sites (landfills) and Superfund program sites.

Landfills, old dumps and domestic sludge-spreading sites within the boundaries of the UEC Planning Area are listed in Table H-3, with an accompanying location map included as Figure H-7.

There are 11 sites on the U.S. EPA Superfund list that are either actual or potential threats of hazardous waste substance releases to the UEC Planning Area. These sites are shown on Figure H-8.

TABLE H-3. Solid Waste Disposal Sites in the Upper East Coast Planning Area.

MAP No.	SITE NAME	TYPE*	STATUS Active /Inact.	LINER	LOCATION T-R-S	ACRES	INFO. SOURCE CODE**	COMMENTS
1	MARTIN CO. LANDFILLS & DUMPS Hobe Sound	100	I	None	39S-42E-31		abd	Closed ~ 1977.
2	Martin Co. I (Palm City I) Martin Co. II (Palm City II) Martin Co. II (Palm City II) Martin Co. II (Palm City II)	100 100 100 100 300	I I I A A	None None 20 mil PVC Clay/PVC/Clay None	38S-40E-7 38S-40E-7 38S-40E-7 38S-40E-7	40 10 5 10	ad a abd ad	Closed 1985. Total Property 388 acres.
3	City of Stuart	100	I	None	38S-41E-16	62	ab	Closed 1980. Proposed golf course. There are 30 public wells within one mile. City was to perform remediation.
4	Town of Ocean Breeze	200	I	None	37S-41E-22		ab	
5	Indiantown Dump	520	I	None			ab	
6	MARTIN CO. WWTP SLUDGE SPREADING SITES Allapattah Properties	400	A	n/a		14,000	e	USED BY: H&H Sludge
7	Allapattah Properties	400	A	n/a		675	e	J&J Baker
8	Bessemer Properties	400	A	n/a		823	e	Martin County Solid Waste
9	Berg: Box Ranch	400	A	n/a		6,000	e	Hutchinson Utilities
10	EASTERN OKEECHOBEE CO. LANDFILLS & DUMPS Okeechobee Co. Yard & Trash Okeechobee San. Landfill Phase I (Berman Road Landfill)	320 100	A A	None	36S-36E-13 36S-36E-13		b b	Owner: Chambers Waste Systems of America
11	EASTERN OKEECHOBEE CO. WWTP SLUDGE SPREADING SITES WITHIN SFWMD Adam's Ranch	400		n/a				
12	ST. LUCIE CO. LANDFILLS & DUMPS St. Lucie Co. II (Glades Rd) St. Lucie Co. II (Glades Rd) St. Lucie Co. I	100 300 100	A A A	60 mil HDPE 40 mil HDPE Marl	35S-39E-36 35S-39E-36 35S-39E-36	60 10 25	abc abc b	Total site 600 acres.
13	Hammond Road (Old City of Ft. Pierce I)	100	I	None	34S-40E-30	40	abc	Closed 1977. Sold to private owner in 1991.
14	Center Road (Old City of Ft. Pierce II)	100	I	None	34S-40E-30	40	abc	Closed 1977. Located 1 mile south of Hammond Rd. Landfill. Sold to private owner in 1991.

TABLE H-3. Solid Waste Disposal Sites in the Upper East Coast Planning Area (continued).

MAP No.	SITE NAME	TYPE*	STATUS Active /Inact.	LINER	LOCATION T-R-S	ACRES	INFO. SOURCE CODE**	COMMENTS
15	ST. LUCIE CO. LANDFILLS & DUMPS (Continued) St. Lucie Co. (Airport West)	100	I	None	34S-40E-19, 20	58	abc	Closed 1963. Across road from Ft. Pierce Landfills 1 and 2.
16	St. Lucie Co. (Airport N.E.)	100	I	None	34S-40E-19, 20	146	abc	Closed 1978 with remediation. Site is now a golf course.
17	White City Landfill	100 300		None	36S-40E-31	15	cb	
18	Stump Dump		I	None	Port St. Lucie		a	Construction/demo. debris.
19	City of Port St. Lucie	100 300	I	None		10	cb	Western Port St. Lucie. Closed 1971.
20	Old County Dump	520 100 300	I	None		20	cb	Closed approx. 1955. Current site of Indian River Comm. Coll.
21	Old Appliance Dump	520	I	None	see comments	10	c	Closed in early 1960s. South of Ft. Pierce City Limit.
22	ST. LUCIE CO. WWTP SLUDGE SPREADING SITES							
23	Biele	400	A	n/a			a	
24	Branscomb	400	I	n/a			a	
25	Dersam	400	I	n/a			a	
26	O'Connell	400	I	n/a			a	
27	Modine	400	A	n/a			a	
28	Stokes	400	A	n/a			a	
29	Frenz Enterprises Sludge Disp. 2	400	A	n/a	T36-R39-10		bc	Lime stabilized septage and WWTP sludge.
30	HES Corp./ Roundtree Citrus Ranch	400	A	n/a	T35-R37-01		bc	
31	HES Trnsp. Sludge Disposal	400	I	None	T35-R39-21		bc	

*CLASS CODES (TYPE):

100 Class I Landfill
200 Class II Landfill
300 Class III Landfill
310 Trash/Yard Trash
320 Trash Composting
400 Sludge/Disposal Facility
520 Old Dump

**INFORMATION SOURCE CODES:

a FDEP, West Palm Beach (Geetha Silvestra)
b SFWMD, Regulation Dept. (Eduardo Lopez)
c St. Lucie Co. Dept. of Public Works (Ron Sigmon)
d Martin Co. Solid Waste Dept. (Ray Cross)
e Martin County Public Health Unit (Charles Hassler/Joe Grusauskas)

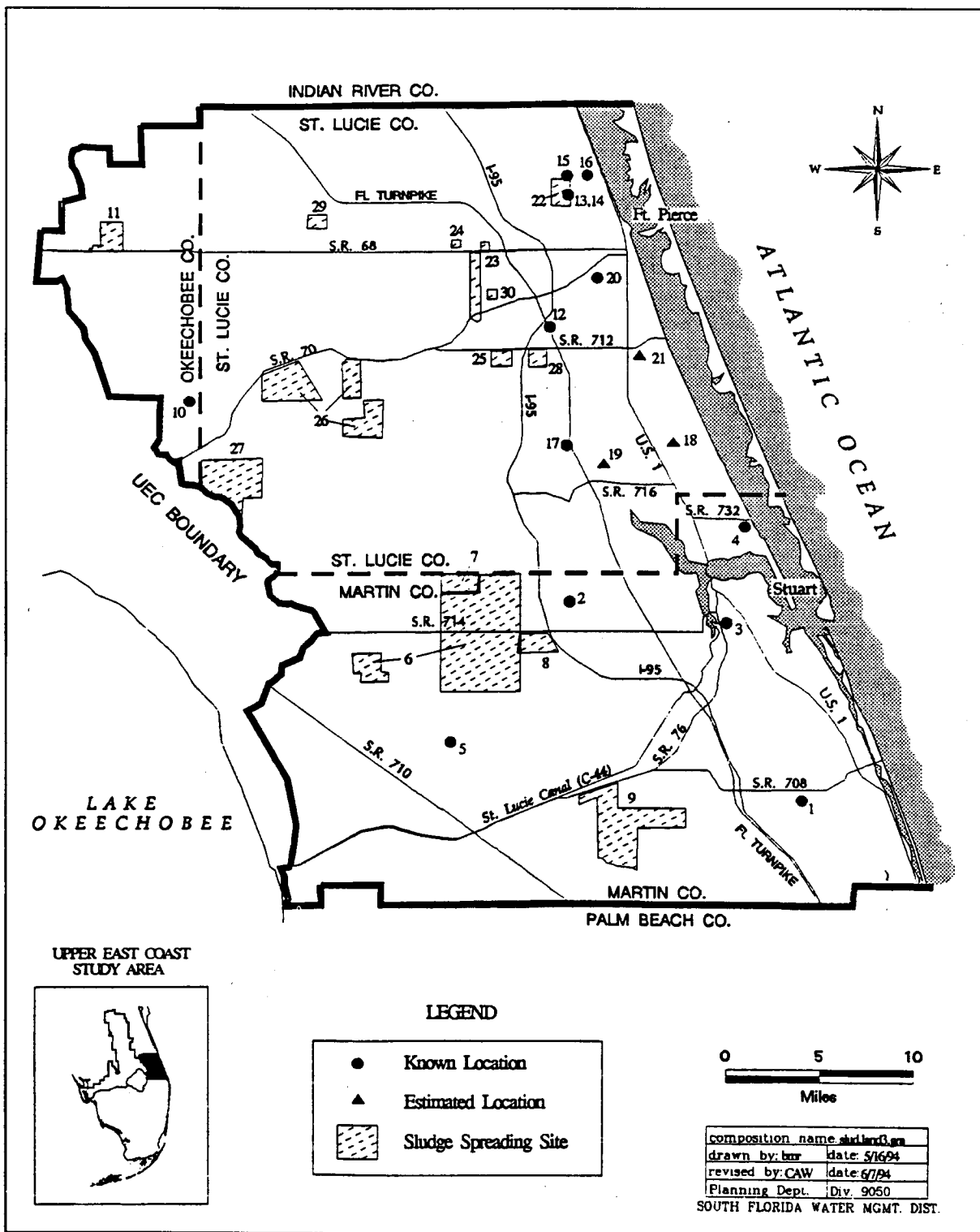


FIGURE H-7. Solid Waste Disposal Sites in the UEC Planning Area.

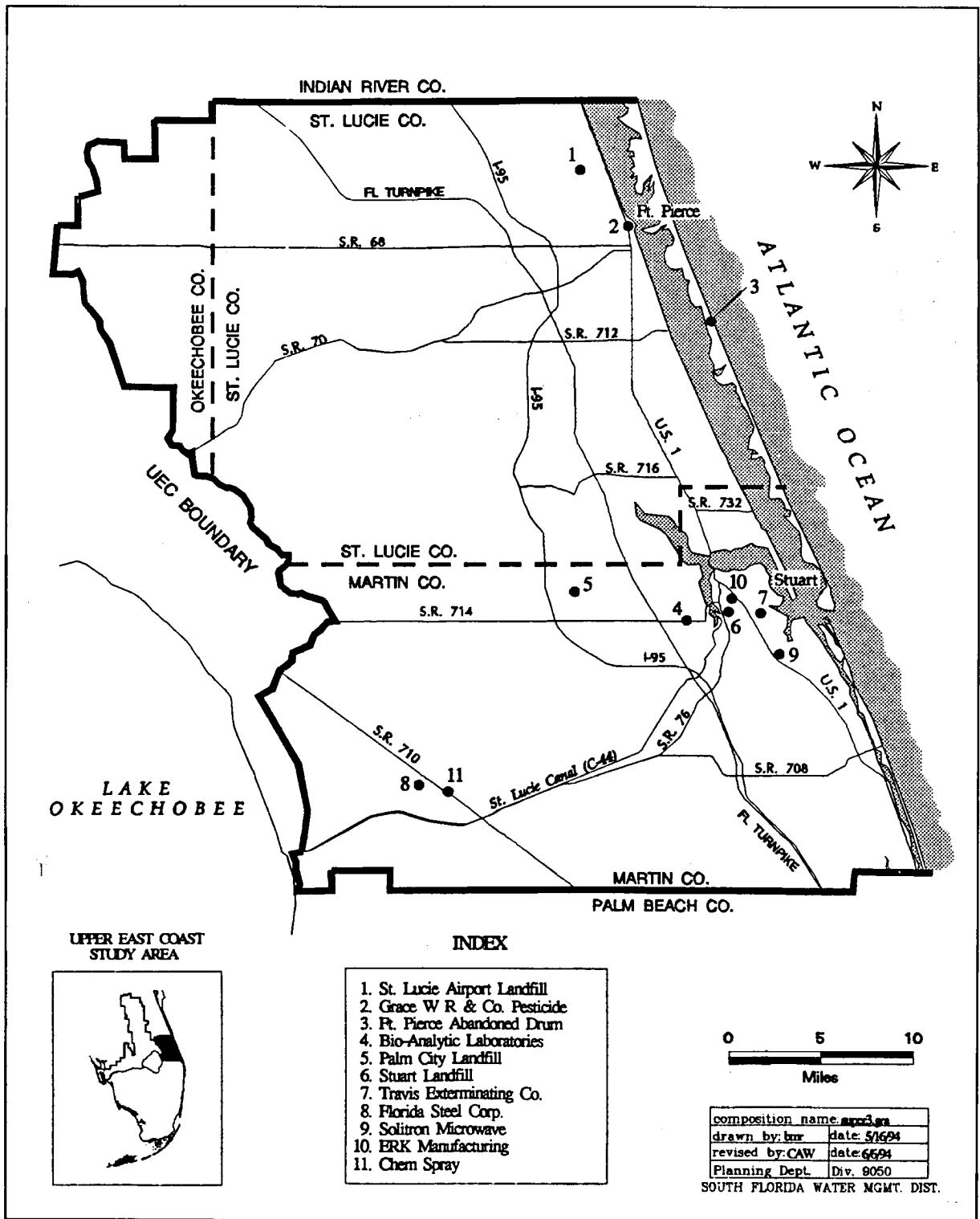


FIGURE H-8. Superfund Sites in the UEC Planning Area.

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WELLFIELD PROTECTION ORDINANCES

Aquifer Protection: Applicable Federal and State Laws

There is no single set of federal or state laws that represents a comprehensive approach to aquifer protection within Florida. Rather, numerous federal and state laws contain a variety of components which are applicable to the protection of ground water resources. Examples of federal legislation include the Safe Drinking Water Act (SDWA); the Resource Conservation and Recovery Act; the Comprehensive Environmental Response, Compensation, and Liability Act; the Clean Water Act; the Toxic Substances Control Act; the Emergency Planning and Community Right-to-Know Act of 1986; and the Federal Insecticide, Fungicide, and Rodenticide Act. The State of Florida, through the Department of Environmental Protection, the Department of Health and Rehabilitative Services (FDHRS), the Department of Agriculture and Consumer Services (FDA), and the Water Management Districts has enacted a series of administrative rules directed toward aquifer protection. FDEP has promulgated a number of different regulations under Title 17 of the Florida Administrative Code (F.A.C.), which function to regulate several types of activities (examples include storage tank systems, hazardous and solid waste, wastewater, underground injection, storm water discharge, etc.) with potential impacts on ground water.

The primary applicable rule regulating onsite sewage disposal administered by FDHRS is codified as Chapter 10D-6, F.A.C., while FDA has promulgated several applicable rules (regulating use of fertilizers and pesticides) within Title 5 of the code. Rules of the WMDs (defining water management activities) are codified in various chapters of Title 40, F.A.C. In addition, the state and local government comprehensive plans (codified at Chapter 187, F.S., and Chapter 163, F.S., respectively) address additional elements relating to ground water protection.

The first cohesive federal effort actually aimed at aquifer protection came in 1984, when the USEPA published its Ground Water Protection Strategy. This strategy recognized the need to prevent future ground water contamination and emphasized the protection of public water supply aquifers or those linked to unique ecosystems. As a result of this approach, federal provisions focused specifically at public water supply well protection were adopted as part of the reauthorization of the SDWA in 1986. This legislation established a nationwide policy to encourage states to develop systematic and comprehensive wellhead protection programs to protect public water supply areas from all man-made sources of contamination, which may cause or contribute to adverse health effects.

By the late 1980s, Florida's Local Government Comprehensive Planning and Land Development Regulation Act, Chapter 163, F.S., was enacted which includes a statutory requirement (under Rule 9J-5, F.A.C.) that local governments implement

comprehensive plans and land development regulations which protect potable aquifers and wellfields.

The primary goal of these legislative policies, aimed at aquifer protection, is to prevent problems before they occur as contrasted to correcting or providing remedial action for pre-existing problems. Thus, the most logical and efficient approach to ground water protection is one which reduces the potential for contamination by controlling land uses overlying the aquifer system.

Wellhead Protection Defined

Wellhead protection is a mechanism of preservation employed in the area surrounding a public water supply well or wellfield. It entails a management process that acknowledges the link between activities that take place in wellfield areas and the quality of the ground water supply for those wells. A Wellhead Protection Area (WHPA) is delineated as the surface area, projected from the subsurface, surrounding a well or wellfield through which water (and potential contaminants) will pass and eventually reach the well(s).

Wellhead protection area boundaries or “zones” are determined based on a variety of criteria (e.g., time of travel, drawdown, distance, etc.) and methods (e.g., analytical/numerical flow models, fixed radii, etc.). Factors such as the physical characteristics of the aquifer supplying water to the well(s), aquifer boundaries, the extent of pumping, the degree of confinement, the vulnerability of the aquifer to surface contamination, and the degree of development and land use activity surrounding the well(s) are used in the process. Because methods/criteria employed and physical conditions vary, WHPAs can range anywhere from a distance of a few hundred feet to several miles from pumping wells. Management activities commonly employed within these protection areas include regulation of land use through special ordinances and permits, prohibition of specified activities, and acquisition of land.

Martin and St. Lucie Counties Aquifer Protection Programs

Ground water protection programs are currently undergoing rapid change. At the federal and state levels, additional information is constantly being compiled, new issues are being raised, and new regulatory initiatives are being developed. Local governments must continually assess these changes, in order to determine the adequacy or inadequacy of their applicable program(s).

Several factors make local ground water protection a complicated undertaking in South Florida. First, the existing federal and state laws supply a jigsaw approach to ground water protection that does not adequately address protection at a local level. Additionally, the SAS hydrogeology is fairly complex, making it difficult to accurately assess the physical nature of the resource. Finally, development pressures in the UEC Planning Area are strong, and the increased numbers of potential pollution

sources that accompany developed areas, including those currently in existence, place an increased water quality burden on the aquifer system. Therefore, determining what type(s) of technological or operative controls constitute a practical and efficient approach to protecting the resource, under a given set of conditions, requires careful analysis.

Despite these difficulties, local ground water protection programs have been established for all counties within the UEC Planning Area. These programs are more sophisticated than merely restricting the type and intensity of various land uses on the basis of their proximity to a public water supply. Recognizing the SAS's relatively high vulnerability to contamination, Martin and St. Lucie counties employ a variety of programs, funding mechanisms, and environmental regulations focused on contamination cleanup and prevention. Examples include the following:

- Hazardous Waste Generators Program
- Petroleum Cleanup Program
- Commercial/Industrial Septic System Monitoring Program
- Solid Waste Program
- Surface Water Quality Management Program
- Waste Oil Collection/Recycling Program
- Amnesty Day Program
- Pollution Recovery Trust Fund
- Storm Water Discharge and Wastewater Disposal Regulations

These programs continue to build on five principle elements which include water management and monitoring, water and wastewater treatment, land use policy, environmental regulations and enforcement, and public awareness and involvement. These elements, when coupled with an effective wellhead protection ordinance, comprise a holistic aquifer protection strategy, which is focused on pollution source control and based upon implementing a variety of regulatory and non-regulatory approaches (e.g., overlay zoning, site plan review, design and operating standards, ground water monitoring, public education, water conservation, household hazardous waste collection, etc.).

As reflected in the current legislative mandates, the primary responsibility for protecting local sources of drinking water belongs to the local governments. The obligations associated with local police powers require these governments to pass and enforce regulations protecting the health, safety, and welfare of the public. Consequently, in the late 1980s, all counties within the UEC Planning Area (in conjunction with the technical guidance and financial support provided by the SFWMD) initiated wellhead protection measures aimed at protecting the region's potable water supply. Although varying in stages of completion, Martin and St. Lucie counties have enacted wellhead protection ordinances. The intent of these ordinances

is to protect and safeguard the health, safety, and welfare of the public by providing criteria for regulating and prohibiting the use, handling, production and storage of certain deleterious substances which may impair present and future public water supply wells and wellfields.

Martin and St. Lucie County Wellhead Protection Ordinances

In striving to assure adequate future potable water resources, Martin County adopted a Wellhead Protection Ordinance in 1993 for the purpose of providing protection to public water supply wells/wellfields throughout the county. This ordinance is summarized in Appendix H. The ordinance incorporates an arbitrary fixed radii of protection about wells within which the use, storage, handling, or production of regulated substances is controlled. Over 70 wells, representing a variety of utilities and eight major wellfields, are encompassed by a static protection zone of 500 feet.

In 1989, St. Lucie County, adopted an Interim Wellhead Protection Ordinance which was designed to be the first step in a comprehensive aquifer protection program (a permanent ordinance has been adopted by St. Lucie County). Like Martin County, the ordinance incorporates a fixed radii of protection about the major public water supply wellfields countywide. The protection zone, represented by a 1,000 foot radial distance, was selected based on field observation of existing contaminant plumes (referenced by Ft. Pierce Utilities Authority) and evaluation of “zones of influence” based on conservative estimates of aquifer parameters and pumping rates.

In general, both ordinances prohibit all new nonresidential activities that use, handle, produce or store regulated substances (as defined by 40 Codified Federal Register (CFR) 302 & 122.21, and Chapter 487, F.S.; and regulated by fixed quantities as specified within the ordinance) within a fixed distance of a public water supply well/wellfield. In addition, the location of septic systems, storm water wet retention/detention areas, and wastewater treatment plant effluent discharges within 200, 300, and 500 feet respectively of a public water supply well/wellfield are prohibited.

A variety of general exemptions are addressed depending on the activity type (e.g., continuous transit regarding regulated substances and vehicular fuel and lubricant use). Special exemptions are granted, if the business can demonstrate adequate protection exists to prevent a contamination event from impacting the water supply. This protection is demonstrated by the implementation of a variety of best management practices as outlined within the ordinance.

Control and/or enforcement of the interim ordinances is administered by the appropriate county offices. In Martin County, this includes coordinated efforts between the Growth Management, Utilities, Building and Zoning, and Public Safety

departments, and the Code Enforcement Division. In St. Lucie County, these responsibilities lie with the Department of Community Development.

Future Considerations

Aquifer protection is a dynamic process, continually undergoing change. The principal goal of any aquifer or ground water protection program is ensuring protection of the resource. Continued urban growth and diversification of the UEC Planning Area presents unique challenges to the local governing bodies. Although Martin and St. Lucie counties have established initial precautions to protect the SAS, much remains to be done. A variety of issues are currently being focused upon by these counties which include:

- Construction and maintenance of hazardous waste collection facilities.
- Continued efforts in creating additional local collection/community service recycling stations for proper disposal of motor oil and lead-acid batteries.
- Assessment of new wellfield sites to accommodate future urban expansion and projected water demands.
- Continued development of conservation programs and reuse programs.
- Continued cooperation between county agencies and farming communities in order to minimize pesticide and fertilizer contamination through the implementation of best management practices.

Future water supply planning must continue to seek solutions for these issues with environmentally sound and economically feasible alternatives. These solutions will serve to minimize the potential for contaminating the UEC Planning Area's potable water supply within the SAS for years to come.

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